



Fabrication of completely free-standing pyrolytic carbon string resonator

Nguyen, Quang Long; Larsen, Peter Emil; Boisen, Anja; Keller, Stephan Sylvest

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Fabrication of completely free-standing pyrolytic carbon string resonator

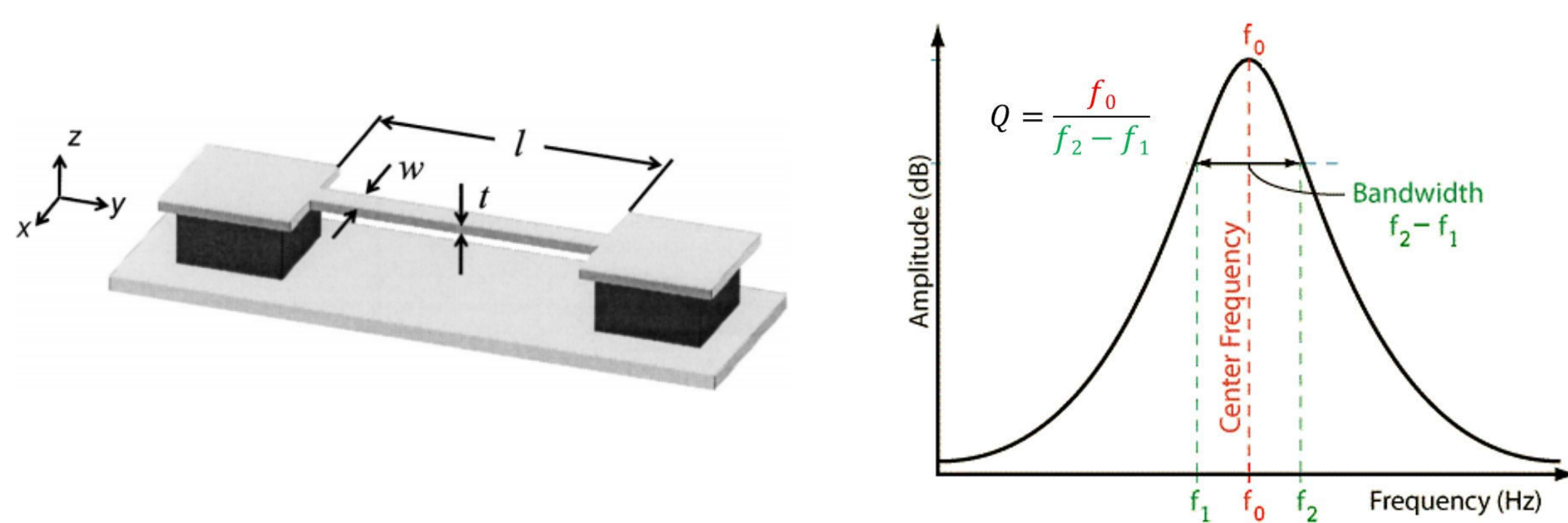
Long Nguyen Quang ^a, Peter Emil Larsen ^a, Anja Boisen ^a and Stephan Sylvest Keller ^a.

^a The Danish National Research Foundation and Villum Foundation's Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics (IDUN), Department of Micro- and Nanotechnology, Technical University of Denmark, 2800 Kongens Lyngby, Denmark;

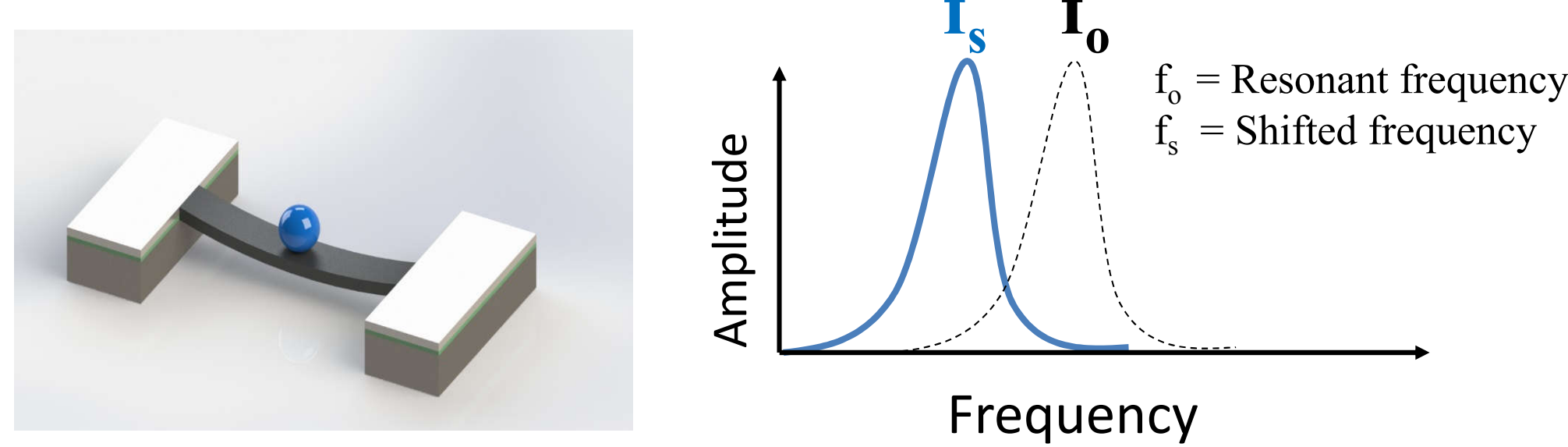
Email: longq@nanotech.dtu.dk



MEMS String Resonator



MEMS String resonator as mass sensor



Features [1]:

- Fast response
- Low power consumption
- High sensitivity
- Small size

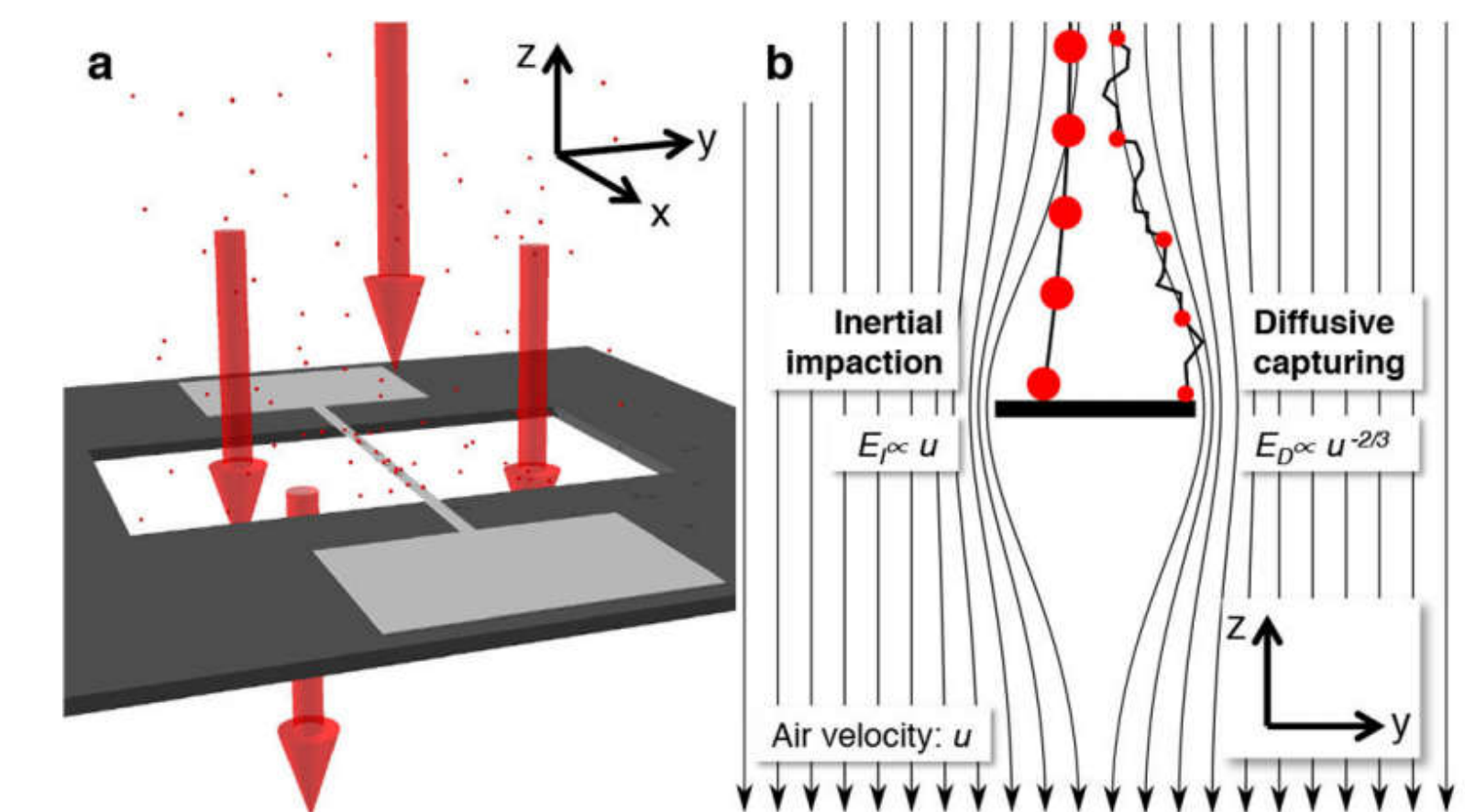
Objective

Fabricate the pyrolytic carbon string resonators with opening from the backside which give:

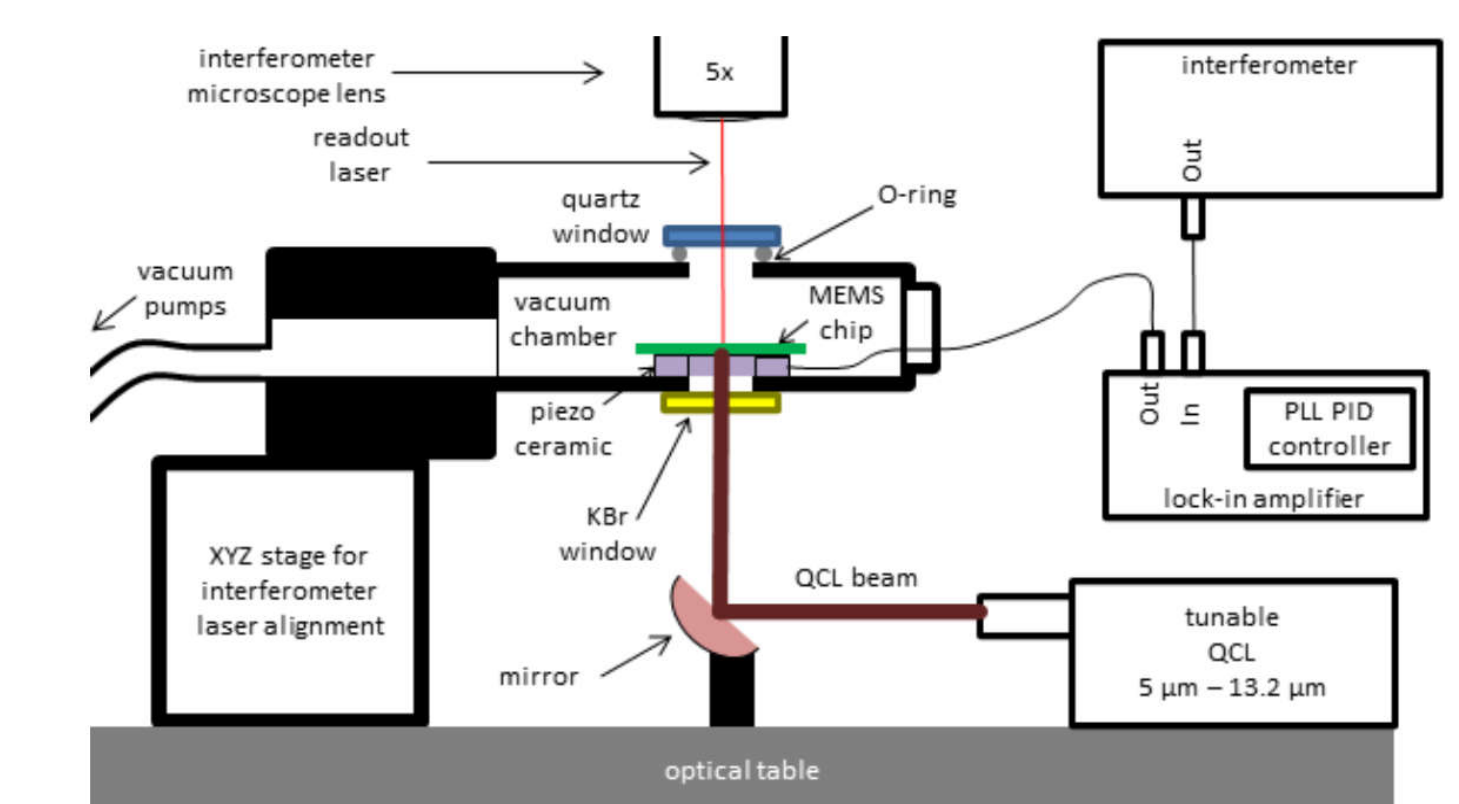
- Convenient for measurement with laser from the backside
- Easy sample deposition
- High resonance frequency and quality factor

Method

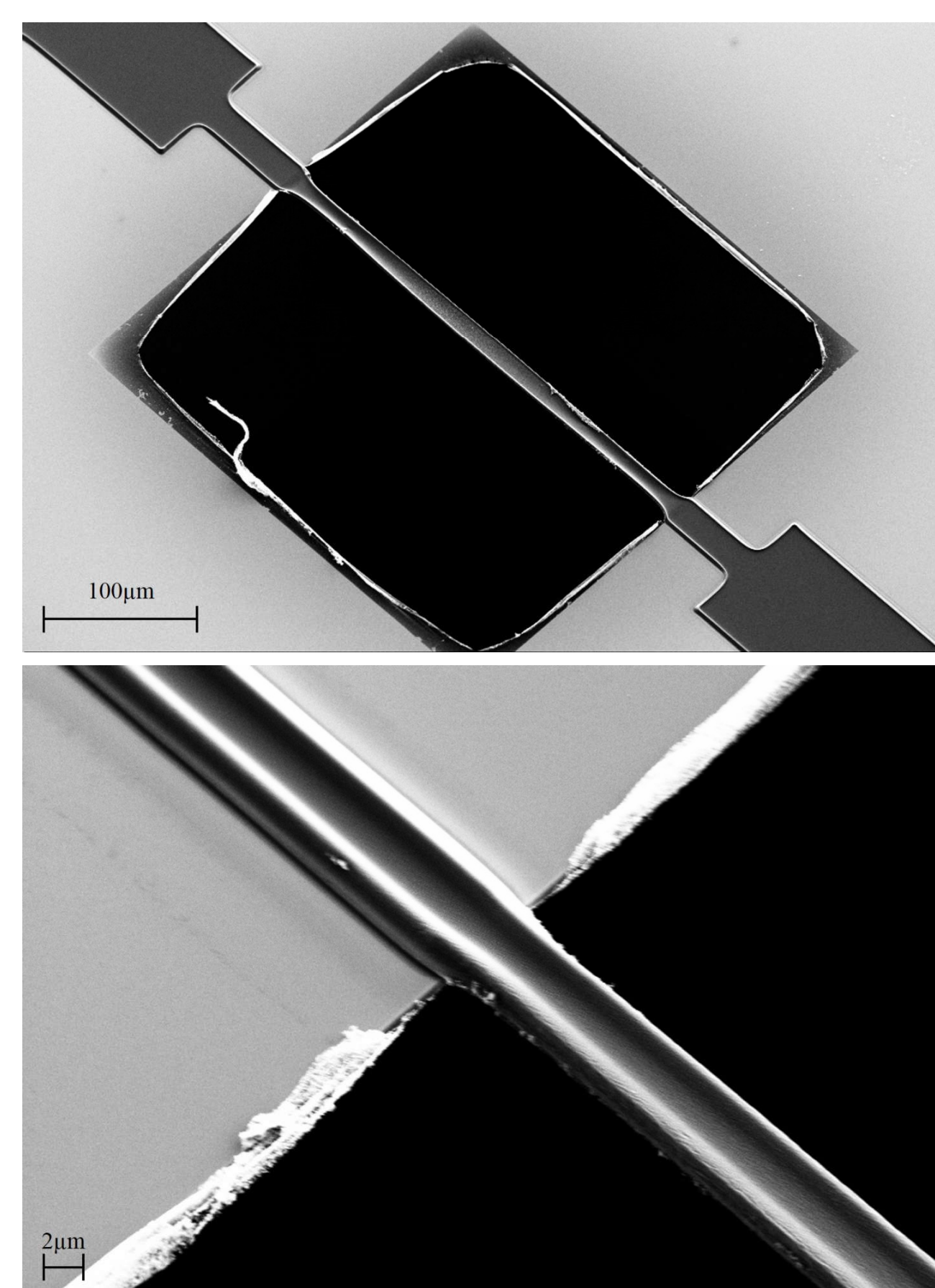
(a) Nanoparticle sampling, (b) Collection mechanisms [2]



Characterization Setup



Fully free-standing pyrolytic carbon string resonator



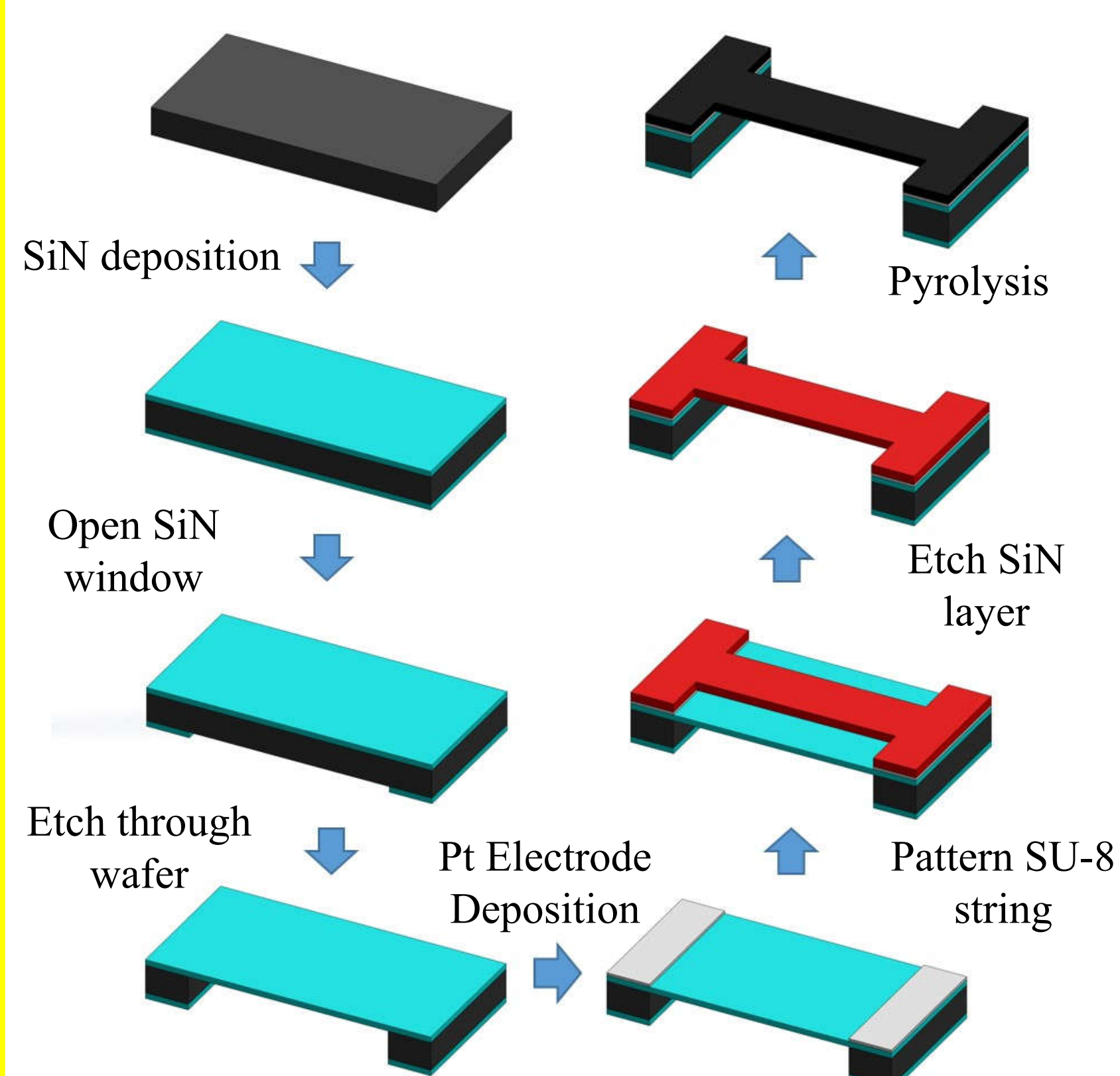
Pyrolytic Carbon (PC)

A type of turbostratic carbons, have similar structure to graphite. In PC the layers are disordered resulting in wrinkles or distortion within the layers.

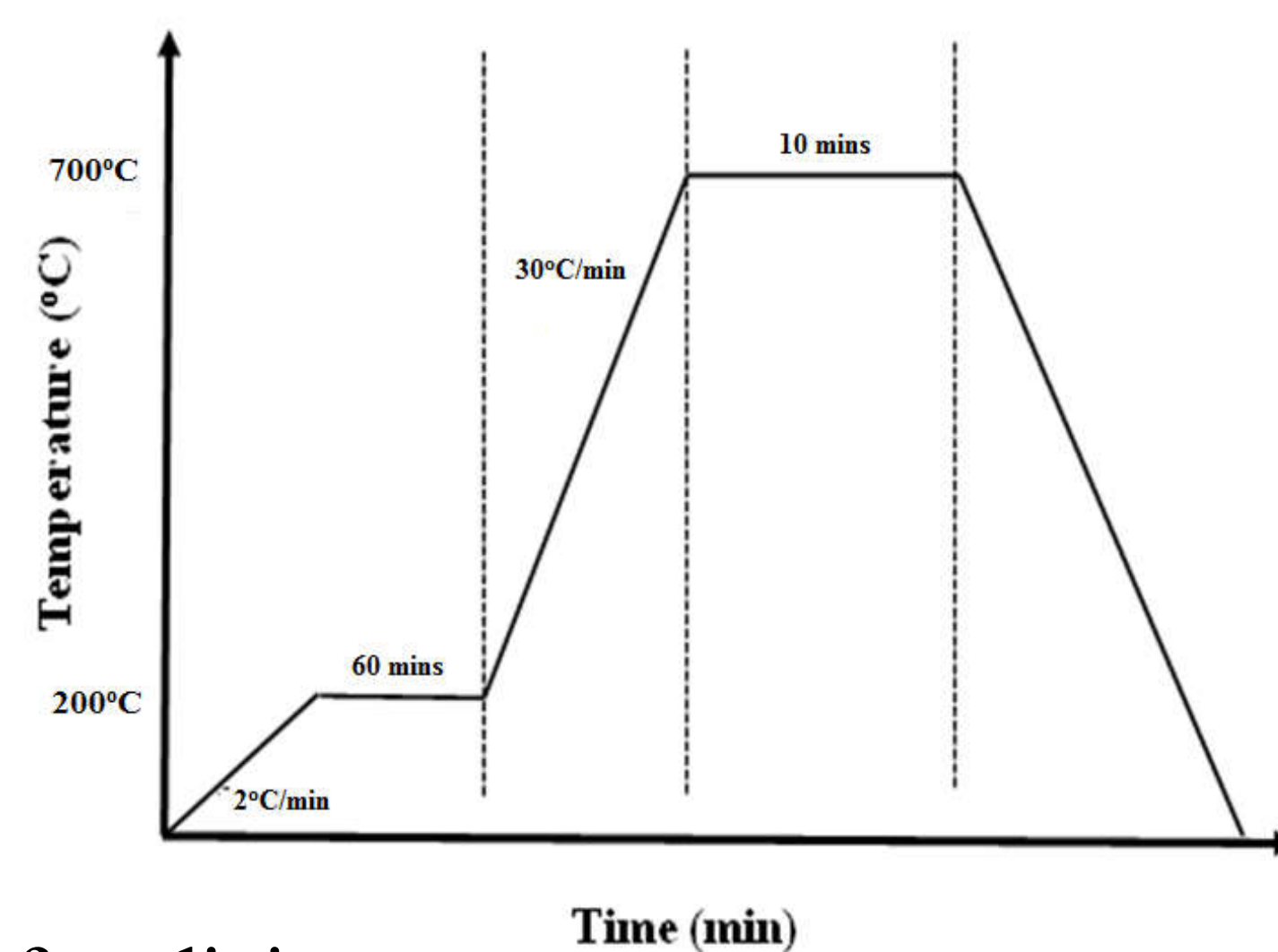
- Features:
- Biocompatible
 - Good wear resistance
 - Controlable
 - Conductive
 - Good durability

Fabrication

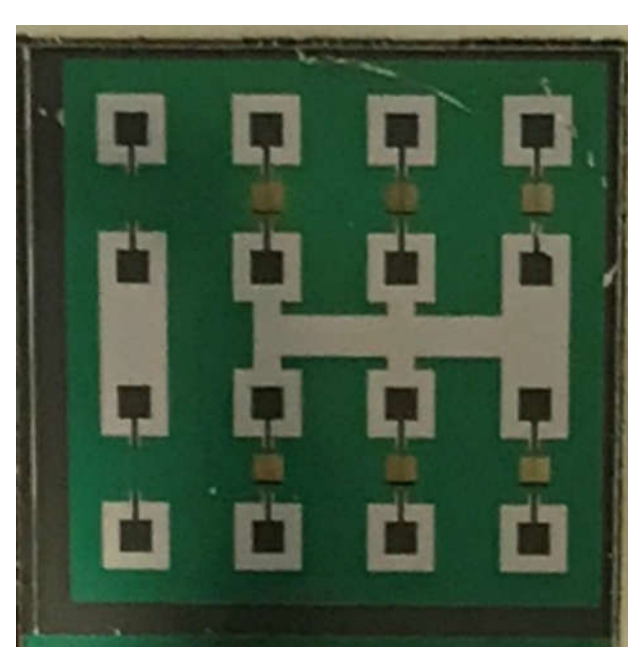
Fabrication process



Pyrolysis process



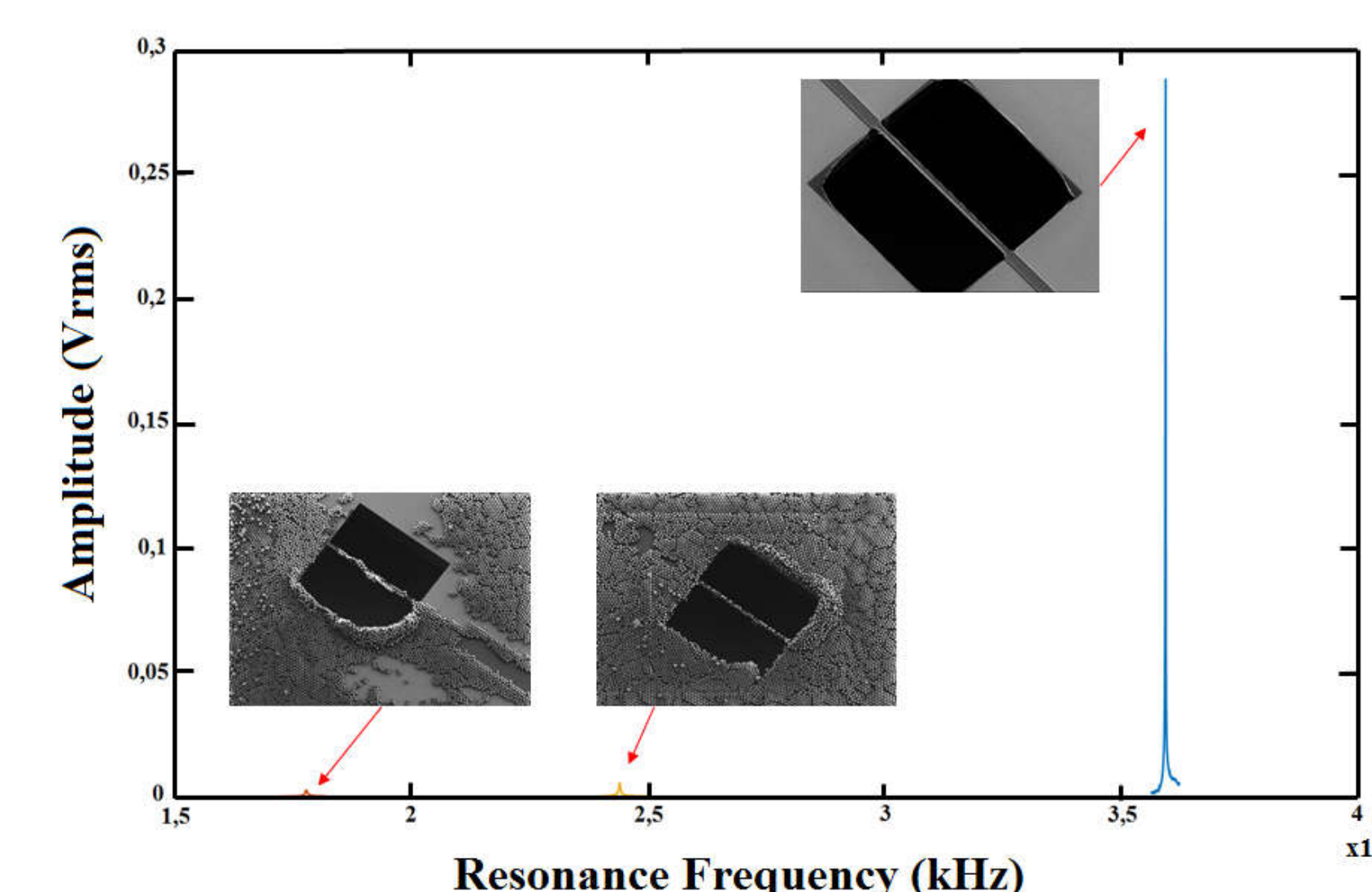
Chip after dicing



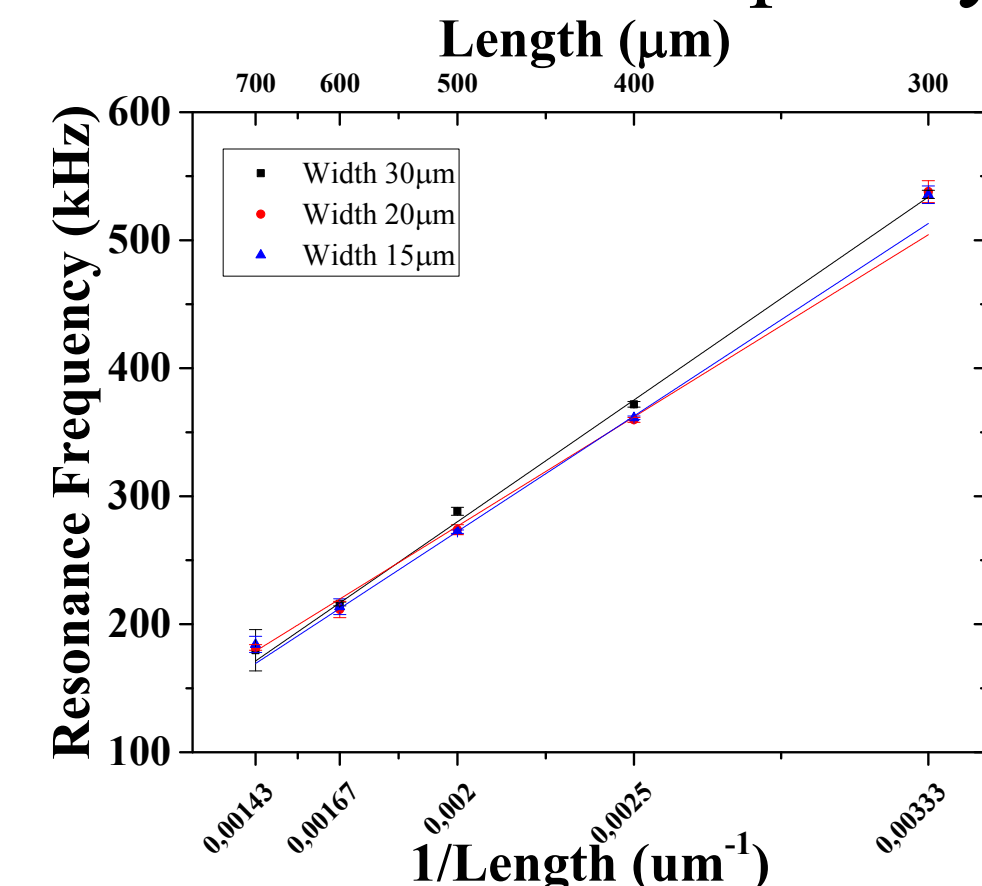
Each chip have 6 carbon string resonators with opening backside and 2 unreleased strings for integrated readout measurement.

Characterization

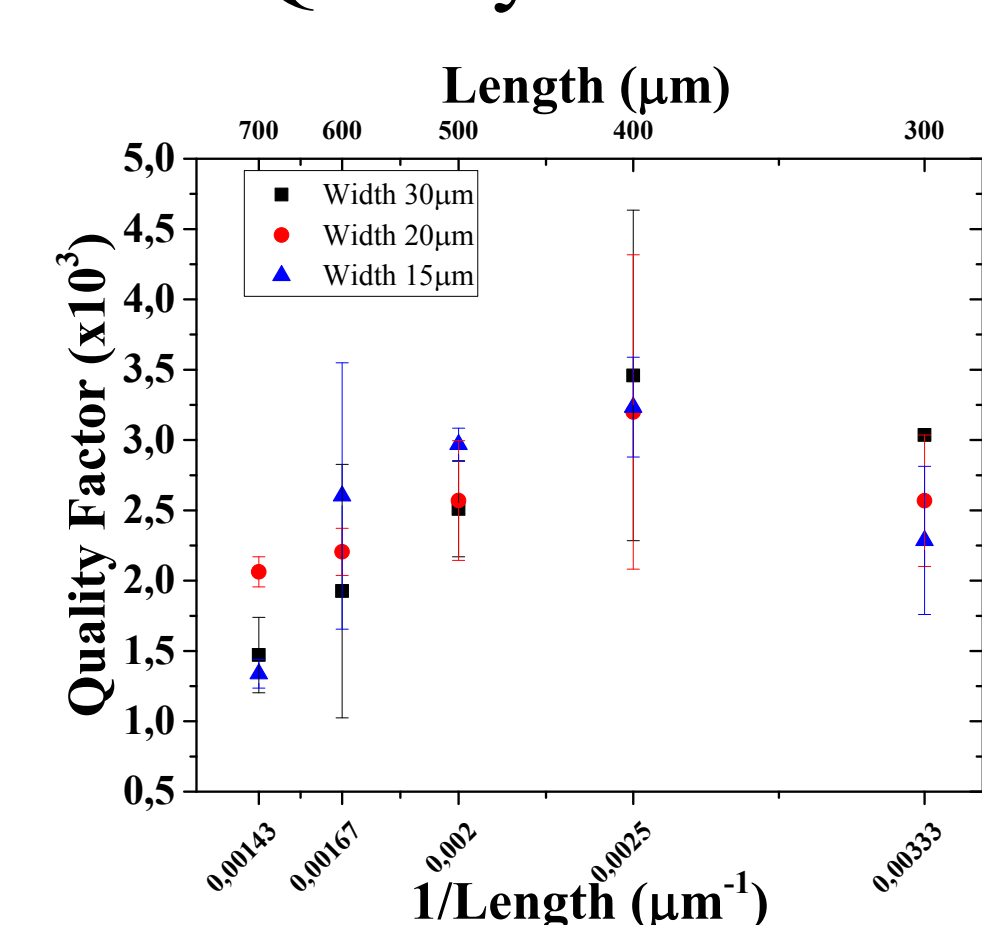
Frequency Shift by adding Polystyrene micro beads



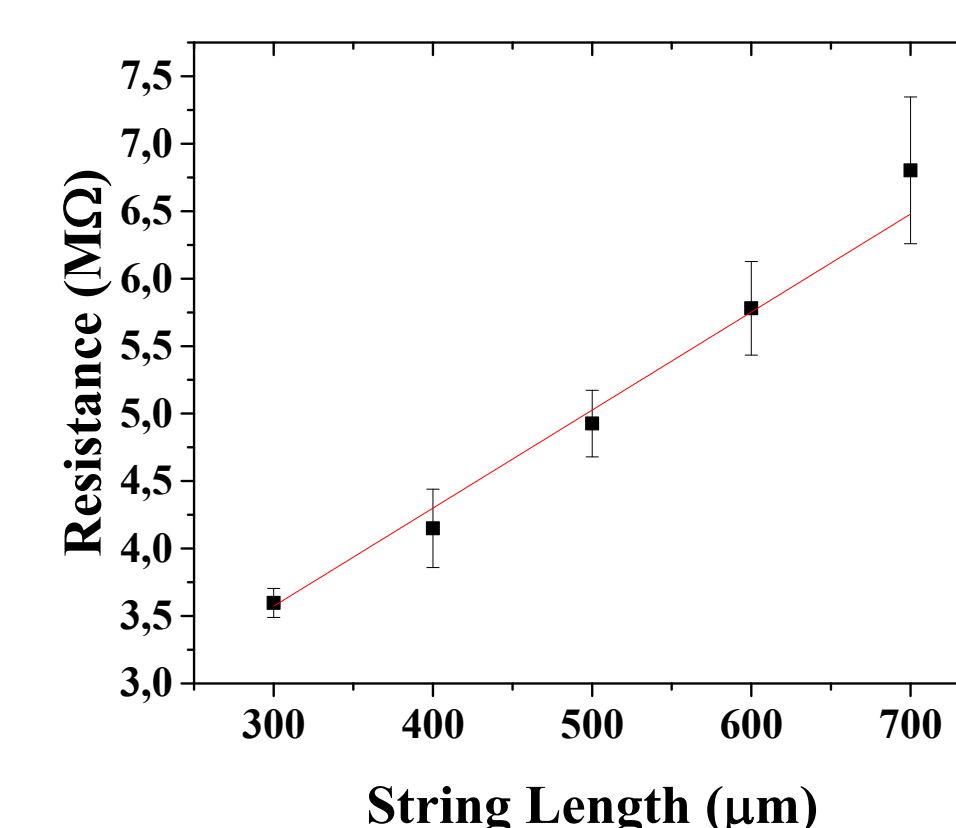
Resonance Frequency



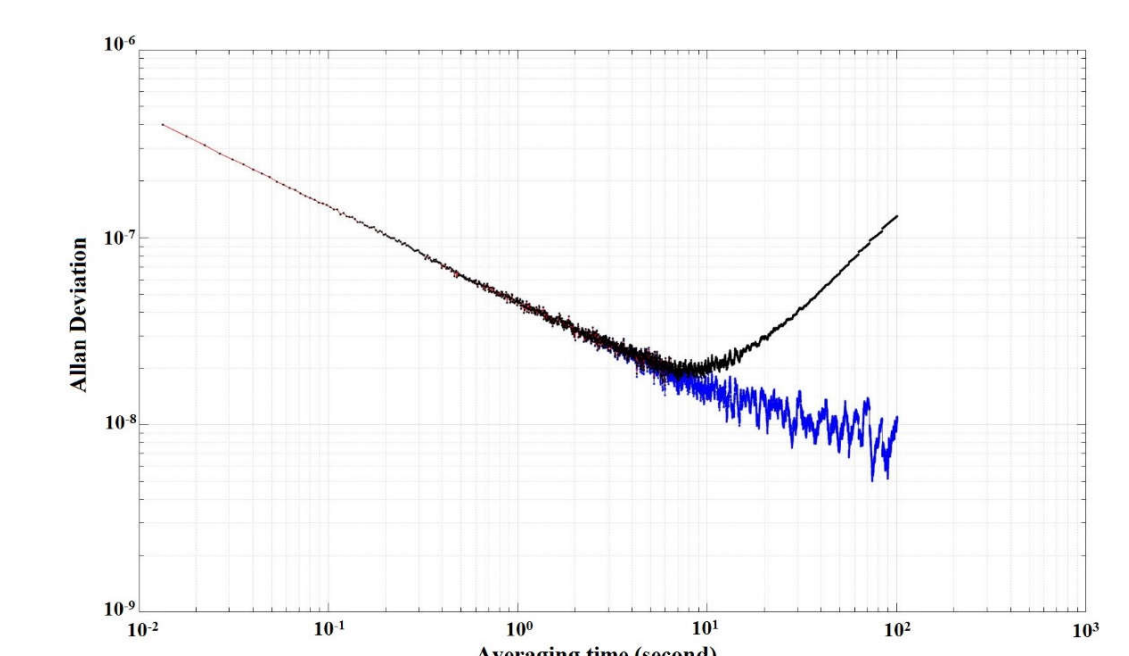
Quality Factor



Conductivity of carbon string



Allan Deviation of 300x30 μm carbon string



CONCLUSION

In this work, we present the fabrication of fully free-standing pyrolytic carbon string resonators which both are suitable for sample deposition and convenient for measurement from the backside laser. The results indicate that the fully free-standing pyrolytic carbon string resonators have a good resonant behavior and it can be used as mass sensor.

REFERENCES

- [1] A. Boisen, S. Dohn, S. S. Keller, S. Schmid and M. Tenje, Rep. Prog. Phys, Vol. 74, 2011.
- [2] Schmid, S, Kurek, M, Adolphsen, J & Boisen, A 2013, *SPIE Newsroom*.

ACKNOWLEDGEMENT

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